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# Understanding the energy use behaviour of British Indian households to shape optimised sustainable housing strategies in existing housing stock

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## Abstract

The notional benefits of more efficient use and effective retrofit to existing housing is both sensible and attractive. Unlike new build, performance improvements cannot be pursued purely by legislation and regulation. Instead, householders need to be persuaded of the material benefits of better energy practices. In improving energy efficiency in the home, providing relevant and useful guidance is critical. Current guidance rarely takes account of specific cultural and ethnic circumstances. The research examines the relationship between cultural values and the energy use behaviour of diaspora households in the UK. The paper presents the results of two surveys that seek to measure energy use practices in the British Indian community. The first, conducted by the authors in England, seeks to understand attitudes and habits in relation to energy consumption in the home for British Indians. This is compared to a wider survey of British attitudes using an identical question set as undertaken by the EnerGAware project. The second survey researches cultural perspectives on the home in a British Indian community. This is compared to an identical survey conducted by the authors with comparative Indian households. The results of the research highlight where behavioural characteristics between the two contexts diverge. The paper suggests there are key areas for future research using ethnographic as well as quantitative techniques to produce tailored strategies for energy conservation in British Indian communities.

**Keywords:** Energy behaviour, British Indian, Sustainable housing

## 1. Introduction

In the United Kingdom, there are 23.7 million dwellings (DfCLG, 2017a) that last year were supplemented by 217,350 new completions (DfCLG, 2017b). Put simply, new builds added only 1% to existing housing stock. To date, most legislation and regulation in respect to carbon reduction in the housing market focuses on new completions, but the reality of long replacement cycles mean that relatively poor performing homes will restrict material improvements in carbon reduction in the sector (SDC, 2006). The notional benefits of more efficient use and effective retrofit to existing housing is, therefore, both sensible and attractive. Unlike new construction, performance improvements cannot be pursued purely by legislation and regulation. Instead, householders need to be persuaded of the material benefits of better energy practices and allied to this, the case for upgrading the fabric and services of their home.

A deeper knowledge of occupant behaviour is crucial for accurate building energy performance prediction (Ren *et al.*, 2016). A study of multi-family houses in Switzerland identified a lack of understanding of behaviour patterns as the root cause of the difference between predicted and actual energy consumption (Becchio *et al.*, 2016). Further evidence from China by Ouyang and Hokao, who investigated 124 households, found that a 10 % saving in energy use was achieved by the active promotion of new modes of household behaviour (Becchio *et al.*, 2016). We can therefore infer that behaviour patterns can lead to substantial reductions in energy consumption. Furthermore, the success of any scheme is dependent on the acceptance, understanding and sensible operation of an upgraded building by its users. Research has identified a disconnect between the projected and actual

performance of housing (Tahir & Walker, 2013), which has led to what is termed a 'performance gap'. This has been framed primarily in the measurable prediction and specification of various enhancement strategies. This performance gap has been correctly identified as being critical to address in order to ensure there is confidence in design and specification advice, especially where its adoption is not obligatory. Although research has established the 'performance gap' between predicted energy consumption and actual performance (Niu, Pan & Zhao, 2016), there is little existing scholarship that considers cultural diversity as a driver of variability in the energy use characteristics of UK households.

The interface between housing retrofit and users has in recent years been subject to investigation with a praiseworthy emphasis on fuel poverty (Makantasi & Mavrogianni, 2016). However, fieldwork focuses on socio-economic groups resident in affordable housing where property management is in the hands of professionals well aware of the economic benefits of improved stock. Whilst strategies to reduce energy in housing are well understood in the state supported sector, owner occupied housing that accounts for 64% of housing stock (Higgins, 2018) in England and Wales is less well understood and consistent data is often fragmented (Oreszczyn & Lowe, 2010). Andrew Karvonen identifies a lack of understanding of social and cultural dimensions to improvement as a barrier to successful energy reduction strategies (Karvonen, 2013). Less well-documented or researched are household groups with distinct cultural values that are overlooked in terms of their understanding and interaction with building performance, thermal comfort and carbon footprint.

To ensure that successful and attractive energy reduction strategies are appropriate to recipient households, knowledge and understanding of the household is critical. This is outlined clearly by Elshakawy and Rutherford who have researched household activities and their relationship to retrofit strategies. They conclude that basic strategies for influencing energy consumption behaviour need to be considered carefully in terms of their target group (Elsharkawy & Rutherford, 2015). In the case of the owner-occupier households research is still relatively scarce. Of the research that does consider household behaviour, Gianfrate et al. have highlighted the importance of understanding tenants' habits for the good use and functioning of technology deployed in the home (Gianfrate *et al.*, 2017). This suggests that having dedicated knowledge of the energy practices of specific ethnic groups will assist in targeted advice and strategies for energy reduction in their housing.

This paper describes research about a specific demographic, that of British Indians and their attitudes, perceptions and preference for energy use and comfort in the home. Immigrants from South Asia constitute more than half of the total ethnic minority population in the UK. Persons of Indian origin are the largest constituent of this group. In this paper the term 'British Indian' is used to refer to individuals born in or who migrated to Britain who are living in the country but whose families have a common Indian ancestry. There was significant immigration from India to England between 1955-1975. This is often attributed to the 1947 partition of India, economic opportunity and status competition among local families and the community (Ram, 1987). Since 1970, the emigration rate has been consistent and persons of Indian ethnicity make up 2.3% of the total population (Census, 2011). British Indians have emerged as a wealthy ethnic group (Lindridge, 2010). This is

supported by data showing 68% of British Indian Households are owner-occupiers (Ministry of Housing, 2017).

The value of this research lies in the use of this information to construct successful energy conservation and retrofit strategies for a demographic where fabric and service enhancements are very much a decision for the householder. This paper presents the results of two surveys that for the first time seek to measure energy use practices in the British Indian community. The first, conducted by the authors in England, seeks to understand attitudes and habits in relation to energy consumption in the home for British Indians. This is compared to a wider survey of British attitudes using an identical question set as undertaken by the EnerGAware project (EnerGAware, 2017). The second survey builds on the first by setting out to understand cultural understandings of the home in a British Indian community. This is compared to an identical survey conducted by the authors with middle class Southern Indian homeowners.

The paper intends to set out energy practices of British Indians both in terms of wider British society as well as in relation to the values of their origin communities. From this, the research will show points of harmonisation between immigrant and host communities as well as divergence in the field of energy use in the home. The paper seeks to identify places of leverage for low energy strategies for housing that may be influenced by cultural and societal values.

## 2. Literature Review

A lack of understanding of the nature of enhancements to buildings by householders has been identified as a significant factor in the shortfall between predicted and actual energy use in the home. This is despite an awareness of climate change as a political and ethical issue and a perception of increasingly stringent regulation (Pan & Garmston, 2012). Part of the difficulty is that quantitative research methods sometimes consider building users as passive recipients of thermal stimuli to maintain thermal balance, as reflected in Fanger's comfort model (Fanger, 1972). Recent studies link occupants' thermal perceptions and expectations to the indoor conditions and to climatic conditions (Berry *et al.*, 2014) and researchers have argued the importance of understanding the expectations and actions of residents in controlling their thermal environment (Berry *et al.*, 2014).

While forming resilient strategies for the provision of sustainable housing, both qualitative and quantitative strategies are essential in understanding social and cultural dynamics and to predict, measure and benchmark performance (Hagbert & Bradley, 2017). A strong quantitative tradition with its roots in *Limits to Growth* has relied on modelling to predict future outcomes (Danilov-Danil'yan, Losev & Reyf, 2009). Most studies evaluating the performance of energy efficient homes or refurbishment design processes remain precise in their measurement of empirical data whilst qualitative enquiry into matters such as individual comfort variation or occupants' energy behaviour is less developed (D.Thomas & J.Duffy, 2013; Konstantinou & Knaack, 2013).

Energy efficiency in the UK is framed by government incentives and regulation. The UK and devolved governments have adopted the well-established approach of 'Fabric First' and give

less attention to the impact of household behaviour on operational energy consumption (Abdellatif & Al-Shamma'a, 2015). Occupant behaviour does affect operational energy use, building services and their control systems (Ahmed *et al.*, 2017). Becchio argues that interactions between occupants and their building can cause variances of up to 36% in energy consumption (Becchio *et al.*, 2016).

Pino and Herde investigated the importance of occupant behaviour and ventilation on the thermal behaviour of apartments (Encinas Pino & de Herde, 2011). Research also suggests that with a clear understanding of the operational conditions, the primary energy requirement of residential buildings can be reduced (Monteiro, Fernández & Freire, 2016). Hayles and Dean argue for a shift in focus from building fabric and technology to that of actions of people occupying these dwellings, as occupants' behaviour and preferences have a greater impact on climate change (Hayles & Dean, 2015).

The impact of cultural behaviour in particular societies in relation to determining operational energy demand can be evidenced. When comparing energy behaviours of households in Japan and Norway, cultural differences mean more energy is used for bathing in Japan, whereas lighting and heating is given a higher priority in Norway (Wilhite *et al.*, 1996). Studies of energy cultures of household behaviour in New Zealand have suggested interactions between cognitive norms, energy practices and material culture (Stephenson *et al.*, 2010). Mills and Schleich also examine the relationships between measures of household energy use behaviour and household characteristics in 10 EU countries and Norway. They established the relationship between family age composition, education and energy behaviour (Mills & Schleich, 2012). Research that focuses on age demographics



predicts higher energy use in the future in Sweden (Carlsson-Kanyama, Lindén & Eriksson, 2005). Al-Marri et al have suggested that awareness be improved through sustainability education to motivate behaviour change as all other parameters have failed to motivate Qatar households to reduce energy consumption (Al-Marri, Al-Habaibeh & Watkins, 2018). Similar trends are recorded by Linden et al in Sweden where households are “energy-unaware” and their ‘perceived lack of time’ defines their energy behaviour (Lindén, Carlsson-Kanyama & Eriksson, 2006).

In turning to the Indian Diaspora, research has recorded attitudes of Indians settling in the United States and their attitude towards possessions in the home. It suggests diaspora communities have complex values in terms of the how they project their identity in the public and private realm (Mehta & Belk, 1991). The act of house purchase by diaspora communities is a means to express prosperity and economic gain (Agrawal, 2006). Indian diaspora communities have values that demonstrate an ‘acceptance of the value, achievement orientation, in a material society that has made Indian immigrants measure success in terms of material possessions’ (Dasgupta, 1989, p.5). In a British context, a distinction is made between British Culture as being individualist in contrast to collectivist values in Indian society (Hofstede, 2001). However, Hutnik (1991, p.138) mentions that a British Indian "may see himself or herself as British and yet positively affirm many aspects of the culture of his or her origin".

Migrant communities often have complex and hybridised identities where settled communities carry social and cultural echoes of their former homes (Hall, 1994; Oonk, 2007). In this field of diaspora studies, Sheetal Sharma remarks for instance that the 'Indian

diaspora' has assimilated itself well with the British society along with retaining its cultural distinctiveness (Sharma, 2017). However, a dominant narrative of assimilation carries the danger of a loss of nuance and granularity in specific areas such as the use and operation of the household. There is, therefore, a complex relationship between British and Indian perceptions that this research addresses.

There are two distinctive aspects to be considered in relation to the British Indian community. Vastu Shastra is a practice of environmental design based upon person-place identity (Sinha, 1998). In India, traditional architecture, Vastu, is informed by the culture, which was dependent on environmental context as well as cultural beliefs (Fazeli & Goodarzi, 2010). The application of Vastu is attributed as the building principles of the programme and which informs the built form (Chakrabarti, 1999). There is a strong cultural interface based in the Hindu tradition that speaks to technology, climatology and building traditions. The original understanding of Vastu in ancient India was developed in its entire system of building technology with the understanding of the climatology (Kannan & Jani, 2010; Patra, 2009). During the colonial rule an English classical prototype prevailed and later synthesised as indo-sarasanic architecture. Contemporary use of Vastu has been more prescriptive with less emphasis on culture. With the limited knowledge and usage of Vastu in the post-colonial period, it has turned out to be more dependent on belief, than the environmental reasons it reflected. Vastu is referenced in diaspora communities when expressing a preference for building orientation when purchasing a house (Agrawal, 2006). There is little published research in the field but the guidance inherent in Vastu Shastra has implications in how buildings are understood and operated.

Secondly, cultural behaviour does vary depending on the nature of diaspora communities. Indian culture and practice often demonstrate behavioural patterns that may affect survey activity. In particular research suggests that in Indian Diaspora communities there is a heightened respect for social and professional hierarchy. Such research demonstrates that Indian communities are more likely to deferring to expectations of those perceived to be in a position of authority (Savani, Morris & Naidu, 2012). At the same time, Indian cultural values can “enfold” or coexist alongside foreign cultural values with a tendency toward confluence and assimilation of host cultures rather than confrontation and difference (Sinha, 1999).

Occupant behaviour has often been framed in terms of income or housing tenure type. In respect to thermal comfort, differences in design temperature in households have the potential to distort consumption predictions based on assumptions that for some demographic groups simply do not hold. An assumption often deployed in energy use prediction is a set point temperature in homes of 18<sup>0</sup> C (Waters, 2017). British Indians, as surveyed, prefer to maintain their homes at 21.4<sup>0</sup> C (Satish, 2017) that diverges as do British demographics (Kane, Firth & Lomas, 2015) from this assumed benchmark. A drop in the maintained internal temperature of a building by 1<sup>0</sup> C in winter in the UK can bring about savings of 10% in heating energy (Nicol, 2012). Such guidance gives a sense of the possible variances in residential energy use for a specific demographic. British Indians being persons of Indian descent residing in the United Kingdom make up around 5% of the total UK population (White, 2012). Taken together, we suggest that fully understanding the perceptions and behaviour of the British Indian community is critically important to refine

and optimise the design and delivery of tailored and culturally optimised energy reduction strategies in homes.

### **3. Methodology**

This paper maps out for the first time how the behaviour of British Indians in relation to energy consumption is related both to British patterns of use and patterns of living with foundations in Indian culture. This research investigates the ‘energy behaviour’ of a diaspora community in the UK, that of British Indian households. It builds on the authors’ work understanding sustainable drivers in housing design in a southern Indian context and the effects of social mobility and development in attitudes towards energy consumption in the home (Satish, Brennan & Pedreschi, 2011; Satish, 2013; Satish & Brennan, 2015). In doing this, a firm foundation is built to tailor effective retrofit strategies for specific diaspora communities in the UK. Research is conducted through survey fieldwork conducted in the UK by the authors. It contributes new data from a particular British Indian demographic through two surveys.

The first survey employed a question set from the EnerGAware project, researching user behaviour in UK households that sampled 2772 households. It was comprehensive in its scope gathering data across a wide range of household activities and user understanding of energy use (EnerGAware, 2017; Jones *et al.*, 2016). The survey did not identify the ethnicity of participants. The authors therefore used the same survey structure with a defined British Indian sample to ascertain any differences in behaviour from the wider population sample.

The authors identified a sample community of British Indians living in and around the city of Plymouth in South West England. Asian Indians constitute 0.6% of the total population in Devon (Census, 2011). This reflects migration patterns for this group outside of established communities in London and the East Midlands. As such the sample group in SW England are settled with a diverse economic profile and are not concentrated in specific neighbourhoods and are spatially assimilated.

Approaches were made to a series of cultural and community organisations in the study area and through a process of referral, a sample of 40 owner-occupier households were identified. Care was taken to include a diversity of ethnic backgrounds originating across India. Different neighbourhoods were sampled including the central area, neighbourhoods adjacent to the main hospital and also peripheral villages. The sample also encompassed a range of occupations, age groups and household structures.

The second survey employed a question set from research conducted by the authors in Southern India in 2011. The original fieldwork sampled 250 households to understand links between middle class aspirations and sustainable strategies in Southern India. The questions related to householders' cultural conception of home (Satish, 2013). The Indian survey sample was chosen to reflect a level of economic prosperity in comparison to a UK context. The study was conducted in the South-Indian city of Mysore. The city was notable as an early adopter of sustainable development features but is now representative of rapid urban growth and development (Chandrasekaran, 1986; Issar, 1991). The study included residents from different occupations and age groups living in the Old Quarter, which features traditional Agrahara layouts, post-independence planned schemes and

communities located in recently built wholly private developments. The respondent profiles reflect this diversity and include government employees, state agencies and the fast-growing software and IT sectors. In total, 250 households were surveyed. The data collected was triangulated and critically compared with the findings of key researchers including Fernandes and Varma (Fernandes, 2000a; Fernandes, 2000b; Fernandes, 2006; Varma, 2007). The authors utilised the same survey structure with the same British Indian sample as in the first survey. This way, the attitudes and practices of the British Indian sample could be compared both with a wider British demographic as well as with cultural values from their originating country.

A Simple Random Sampling technique was adopted to include a proportional representation of samples from different age groups, backgrounds, periods of migration and locations from within Plymouth. This technique achieves a higher statistical precession and hence smaller samples yield significant results (Bryman, 2008; Groat & Wang, 2002). The Quantitative survey data was analysed using SPSS software and are triangulated with the literature and primary survey conducted in Mysore (Balnaves, 2001; Vogt, 2007).

This study seeks to identify potential points of convergence and divergence between a British Indian sample and existing data from a broader Indian and British demographic in respect to attitudes towards thermal comfort and energy use in the home. Table 1 shows the mapping of some of the survey question to sample groups, which are analysed and discussed in this paper.

Table 1. Comparative Study of UK and South Asia: Attitudes to the Household.

<b>Survey question</b>	<b>Question source</b>	<b>Survey : India</b>	<b>Survey: EnerGAaware</b>	<b>Follow-on Survey: British Indians</b>
I don't understand how my home uses energy	EnerGAware 2017			
I have control over how much energy is consumed in my home	EnerGAware 2017			
I often think how I could save energy	EnerGAware 2017			
I am not able to save any more energy	EnerGAware 2017			
You want your house to display	Satish 2012			

In case of constraints we prefer to compromise on	Satish 2012			
Preference for Vastu	Satish 2012			

## 4 Survey Results and Findings

### 4.1 Survey Results and Findings: British Indian and British Households

The first part of the survey conducted by the authors in Plymouth sought to ascertain similarities and differences between British Indian and wider British households. The ability of migrant communities to assimilate lies not only in economic and cultural frameworks but in the realities of thermal comfort adaptation, a key difference between the two countries. This section employed questions addressed to households classified as White British as part of the EnerGAware project and then addressed the same questions to a British Indian sample based in Plymouth. The issues raised are about the understanding of energy usage in the home, and that of a household's awareness as well as agency to change their energy consumption.

The first question posed is illustrated in Fig. 1. It asks if households understand how their homes use energy. There was a marked difference in response between the two survey groups. 45% of British households tend to or strongly agree that they do not understand energy use within their home. In contrast, only 25% of British Indian households expressed a similar lack of understanding. This becomes more pronounced when over a third of British Indians strongly disagree that they do not understand patterns in their energy consumption.



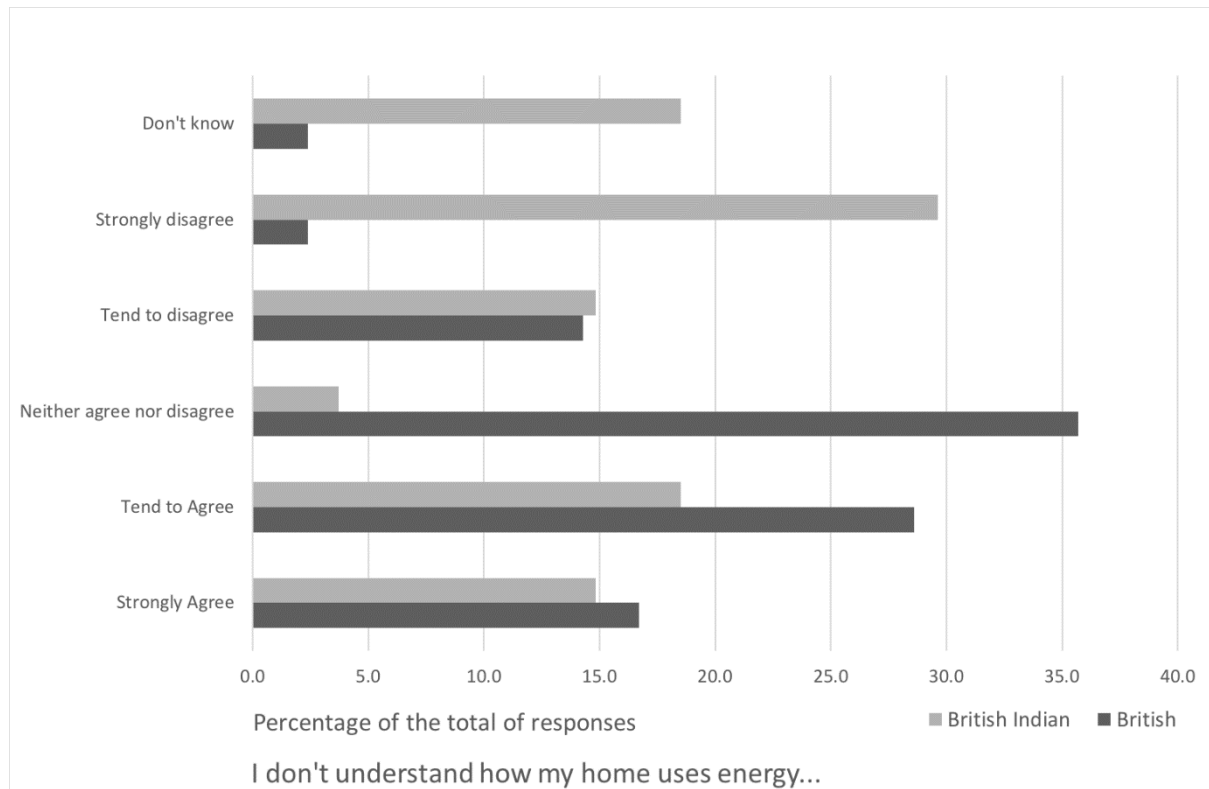


Fig. 1. Respondents' understanding of energy usage.

The second question asks residents the extent to which they agree with the statement 'I have control over how much energy is used in my home' (Fig. 2). The question differentiates between user management of consumption and the underlying factors that affect energy use. Here, the two samples are quite similar in their response. Use of the thermostat, timeclocks and radiator valves, for instance, are immediate and easily understood ways of regulating energy use. Therefore, it is not surprising to see broad consensus and understanding between British and British Indian households around this issue.

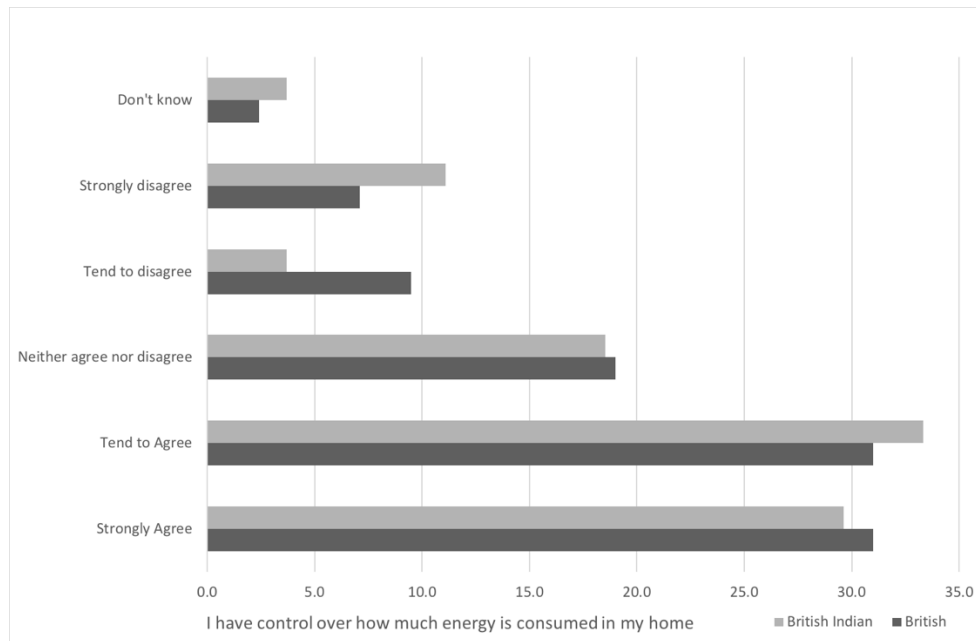


Fig. 2. Respondents' understanding of energy consumption.

Both British and British Indian households were questioned how often they think about saving energy in the home by being asked to comment on the statement 'I often think about how I could save energy' (Fig. 3). Unsurprisingly, given universal sensitivities to utility costs, a large majority of both communities agreed that it was an issue that provoked much thought. 75% of British Households and 90% of British Indian Households agreed or strongly agreed.

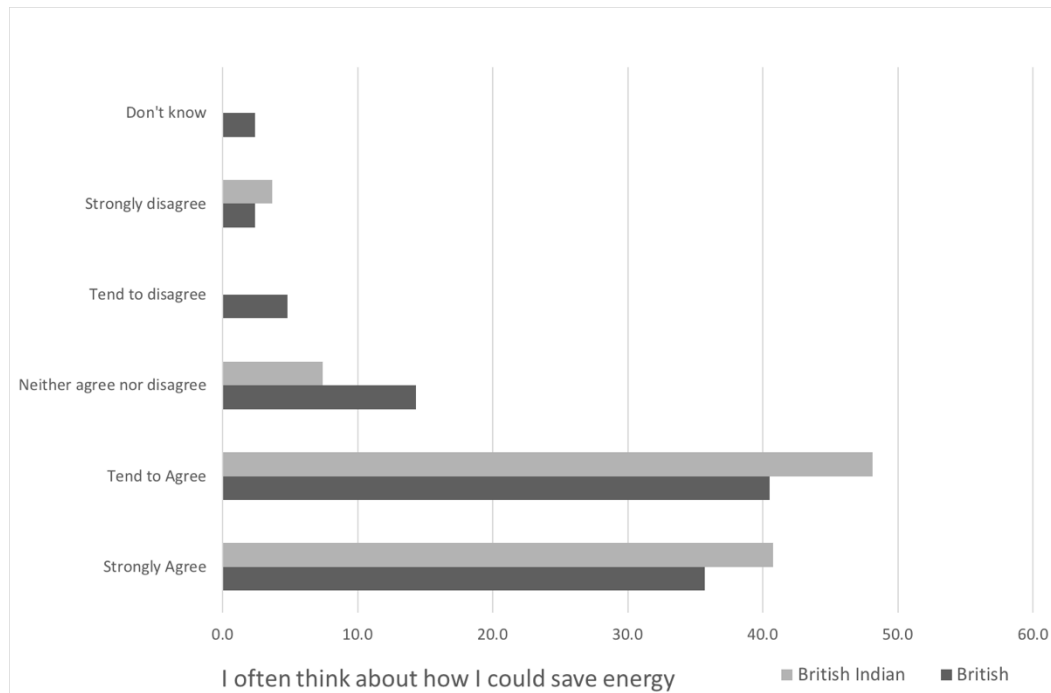


Fig. 3. Respondents' willingness to save energy.

Both British and British Indian households showed broad agreement with the statement 'I am not able to save any more energy' (Fig. 4). Some uncertainty is suggested in the response of British Indians, as nearly 30 per cent neither agree or disagree. This suggests a lack of awareness and relevant information in that 40 per cent of British households do not know whether they can reduce further their consumption. Both British and British Indian households are quite aware of how to regulate energy consumption through controls but at the expense of thermal comfort. In terms of reducing energy demand as opposed to restricting its use, both samples largely agree that they do not have the wherewithal to effect conservation measures.

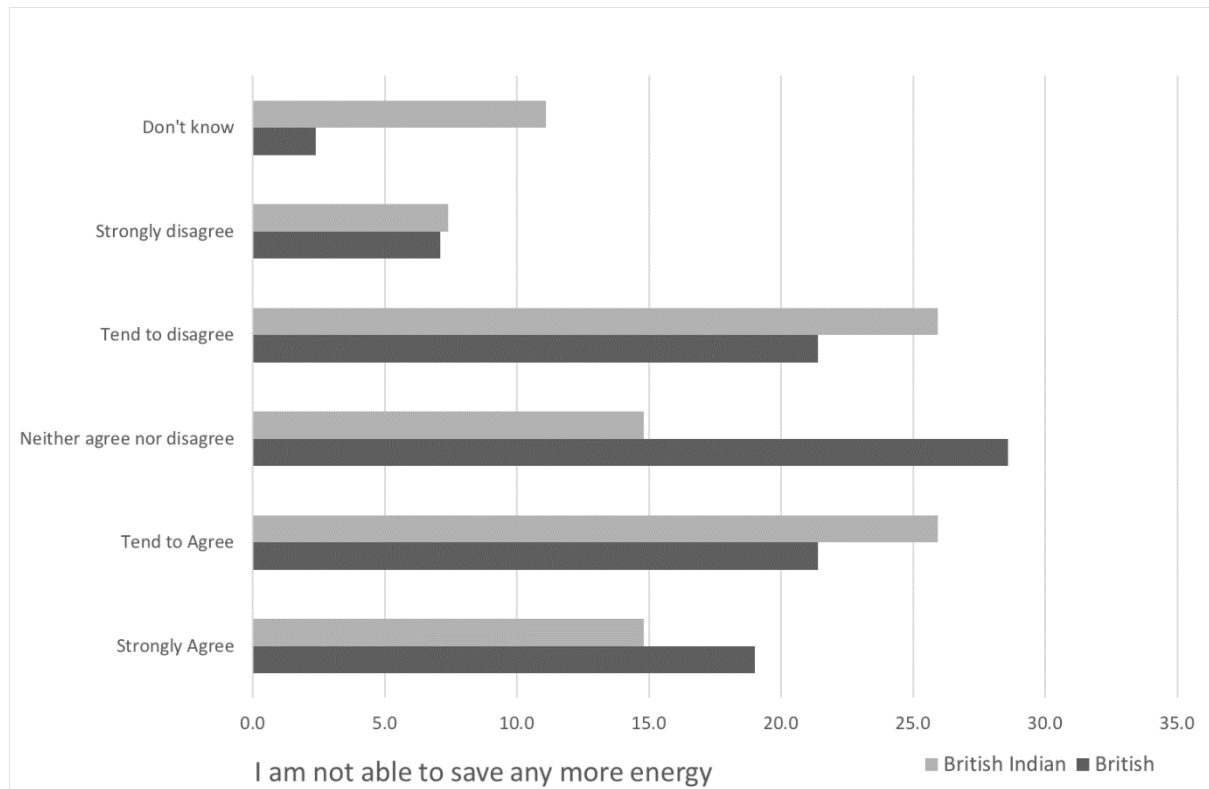


Fig. 4. Respondents' ability to save energy.

When questioned about energy perceptions the samples diverged about understanding how their homes use energy. 45% of British households agreed they do not understand energy within the home in comparison to only 25% in the British Indian sample (Fig. 5).

Additionally, more than 75% of British Indians strongly agree that their family and friends say it is important to save energy whereas less than 60 % of British households strongly agreed with this question.

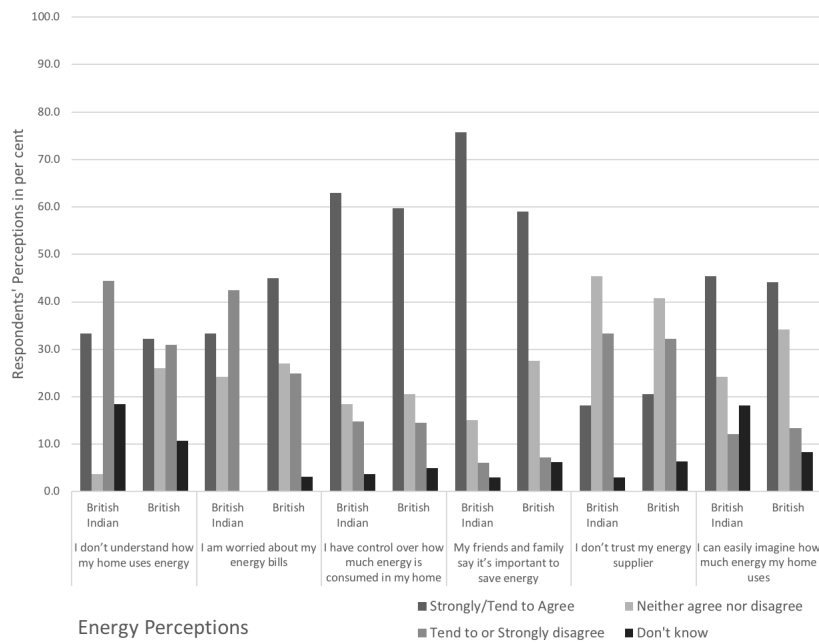


Fig. 5. Energy Perceptions.

A similar trend is evident around the samples' attitudes to 'Appliance-related behaviour' (Fig. 6). In most aspects, British Indian households showed a higher propensity to use appliances more carefully. This is illustrated in the findings by 55% of British Indians using the dishwasher when it is full, whereas, only about 15% of British households wait for the full load to operate dishwashers.

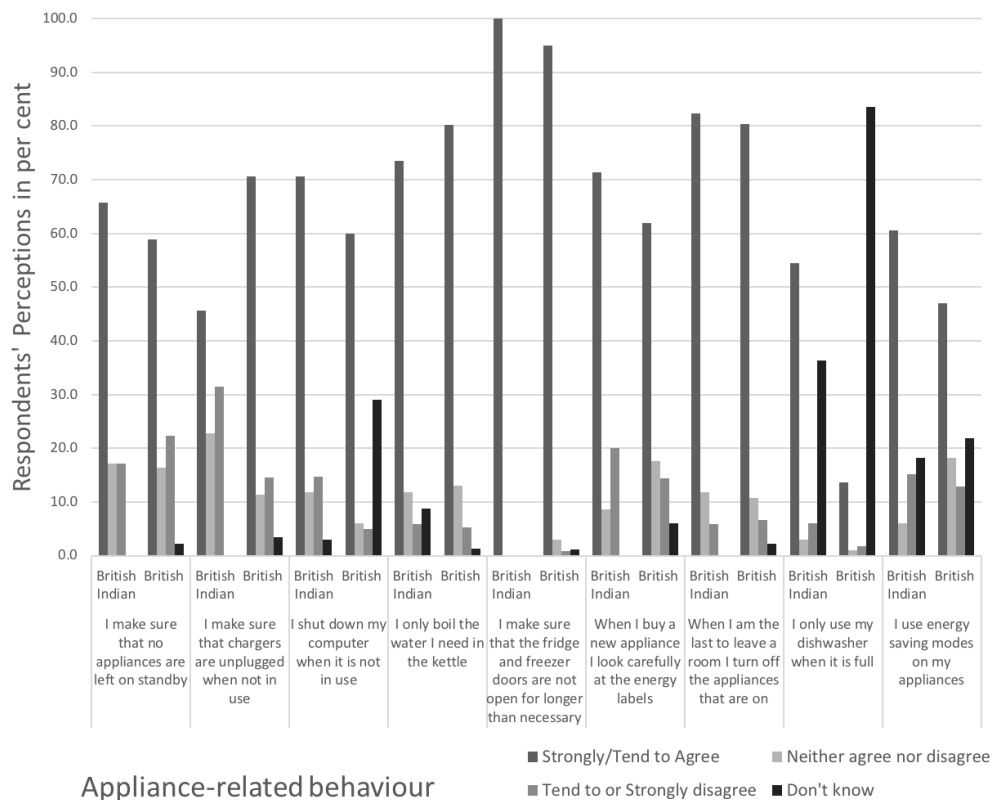


Fig. 6. Appliance-related behaviour.

These responses indicate a sensitivity towards energy use. All the British Indians responded positively to 'make sure that the fridge and freezer doors are not open for longer than necessary' and wished to embrace energy-saving means where feasible.

In enquiring about other energy-related behaviours (Fig. 7), some differences between the samples were observed. British Indians tended to spend more time in the shower compared to British households. There is some inconsistency as when participants were asked 'if they tell people to do things to save energy', 47% of British Indians agreed as opposed to 32% of the wider sample. Practices such as taking longer showers may therefore indicate a cultural predilection rather than an energy awareness in the activity.

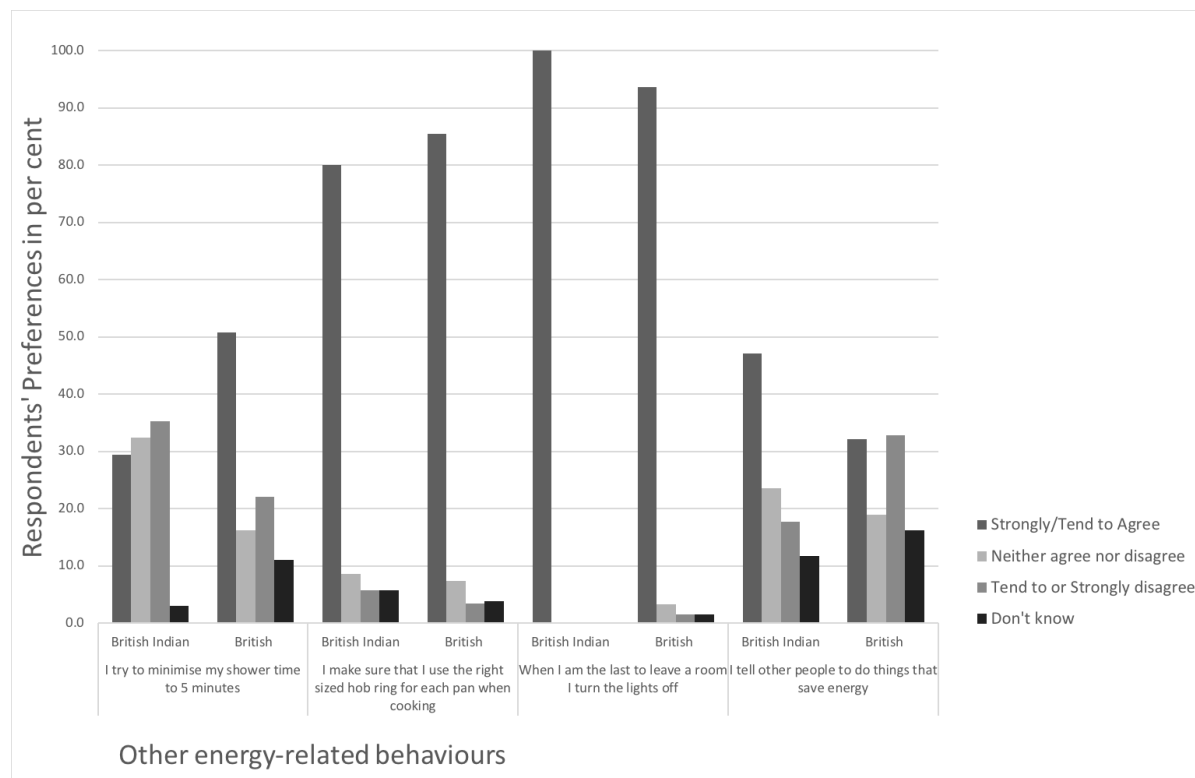


Fig. 7. Other energy-related behaviours.

#### 4.2 Survey Results and Findings: British Indian and Indian Households

The first survey related similarities and differences in the perception of household energy use between British Indians and the wider population. To help in understanding the nature of any divergence in behaviour, a second survey was undertaken to establish any similarities and differences in the perception of the home between households occupied by the South Asian Diaspora in England and comparable communities in India. The questions were based on the values householders wished to project through their home and the priorities they have given their finite financial and spatial resources. The survey facilitates the enquiry of socio-cultural practices and its influence in delivering energy-efficient housing. (Bryman, 2008; Satish, Brennan & Pedreschi, 2011; Satish & Brennan, 2015; Skea & Nishioka, 2008).

Research in India was conducted in the city of Mysore. Housing exists here in a legislative environment where there is little regulatory pressure to reduce one's carbon footprint alongside a free market in housing. Any adoption of sustainable measures in the home are either through sensitivity to utility costs or harmonising with wider aspirations towards social and economic improvement (Satish, Brennan & Pedreschi, 2011).

The first survey question was 'What do householders want their homes to represent, in terms of wealth, status, cultural and social taste?' (Fig. 8). The survey showed some divergence between British Indian and Indian households. Indian respondents have a strong sense of the home as a means to project cultural and economic value. Fig. 8 showed attitudes between the geographically separated communities. The individual response categories were prepared with reference to the emerging middle-class demographic in India. The term 'character' was used to reflect the social capital of the household; 'wealth' and 'status' represent economic capital; 'cultural taste' was a means of understanding any perceived cultural capital in the household (Mcmichael & Shipworth, 2013).

The house as a means of displaying affluence drew the highest response at 35% of all responses followed closely by the house as a projection of status and character at 24%. In part, this can be explained in the way India has seen fundamental changes in the way in which home-owning classes see themselves. There has been a movement from a position of almost intellectual self-restraint to one where the visible characteristics of consumption, style and the social distinction is paramount (Fernandes, 2000b; Fernandes, 2006). In this process, the home has recently become a vehicle for middle class households to



communicate their circumstances in the public realm (Fernandes, 2000a; Fernandes, 2000b).

In contrast, when the British Indian sample was surveyed using the same questions, the home was seen as much less important as a means of advertising the household's wealth and status. Indeed, in respect to material wealth, none of the respondents felt it important. In contrast, the home as a communicator of cultural taste was important with a third of respondents citing this as being important, in comparison to less than 5% of households in India (Fig. 8).

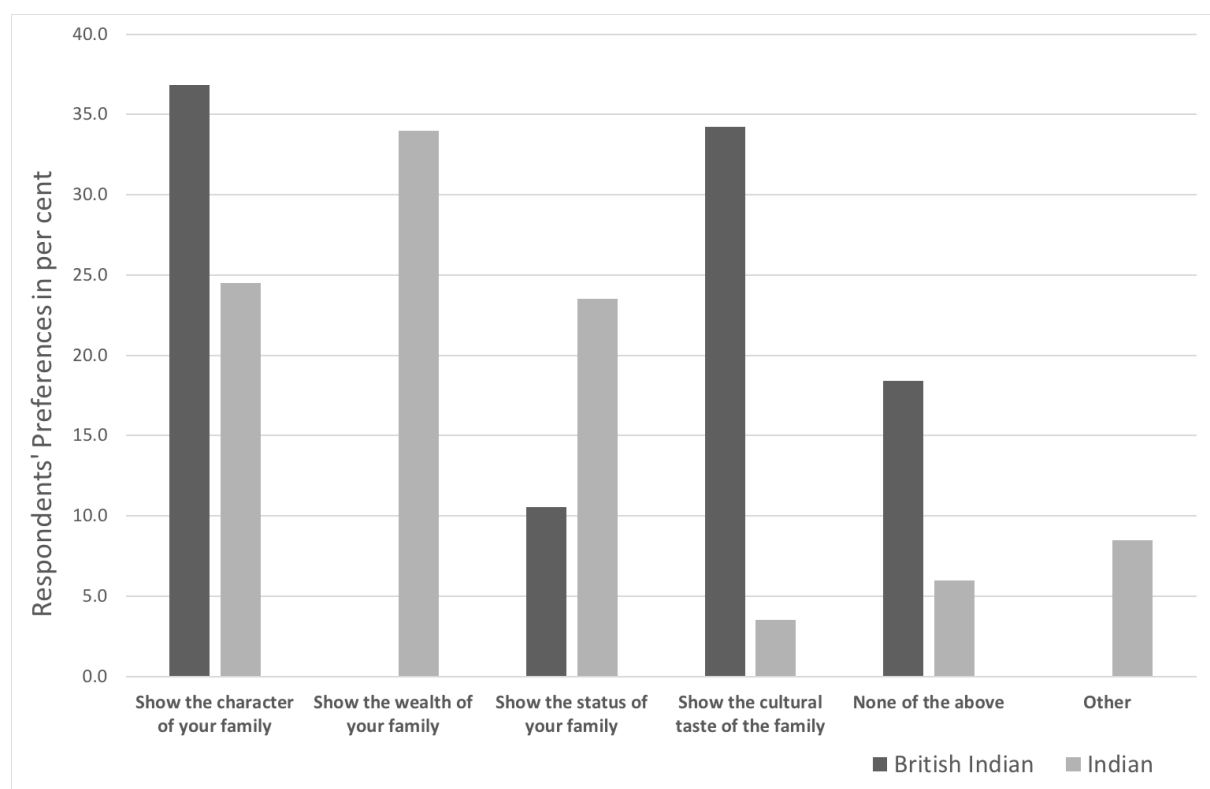


Fig. 8. Respondents' preferences for their home appearance.

The second series of survey responses seen in Fig. 9 were based on priorities for the home and the compromises to be made when expenditure was constrained. Issues of room size and materials were deemed important by 10-15% of all households. Furniture provision was

seen as an item of compromise by both communities. Some divergence was found in the number of rooms that Southern Indian households were willing to sacrifice in acquiring a home. The first survey response from India suggested this divergence on the grounds of the housing having fewer apartment rooms and therefore, any reduction would impact on the need to accommodate the extended family (Satish, 2013). In terms of expectations for building equipment, UK Indian households saw no room for compromise as they perceived it to include heating and hot water supply. In the UK such services are seen as essential and always assumed, in some form, to be included in the home.

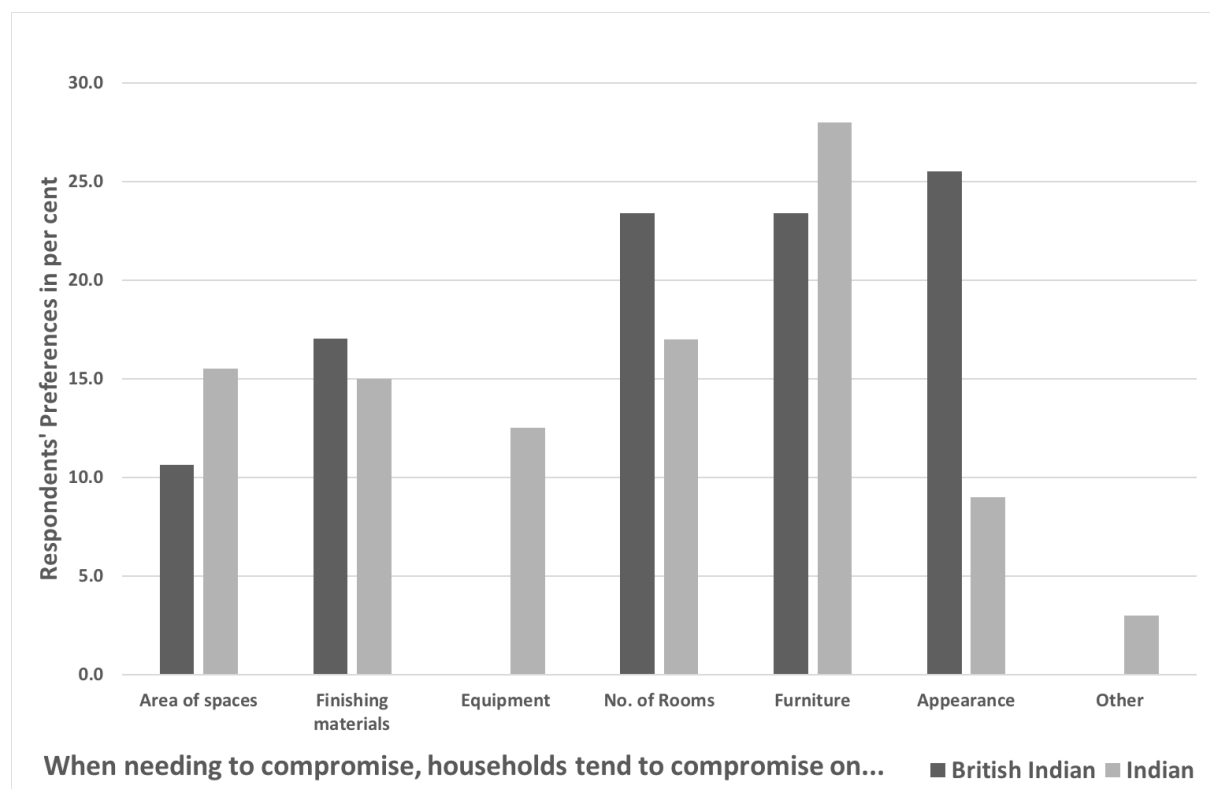


Fig. 9. Respondents priorities in the case of constraints.

Vastu Shastra is a Hindu tradition that speaks to technology, climatology and building traditions. The original understanding of Vastu in ancient India was developed in its entire

system of building technology with the understanding of climatology (Kannan & Jani, 2010; Patra, 2009). The extent to which the knowledge and practice of Vastu have developed has not been researched in any depth in Britain. The survey asked if there was a preference for the teachings of Vastu (Fig. 10). Responses showed a similar affinity for the term in two very different geographic contexts.

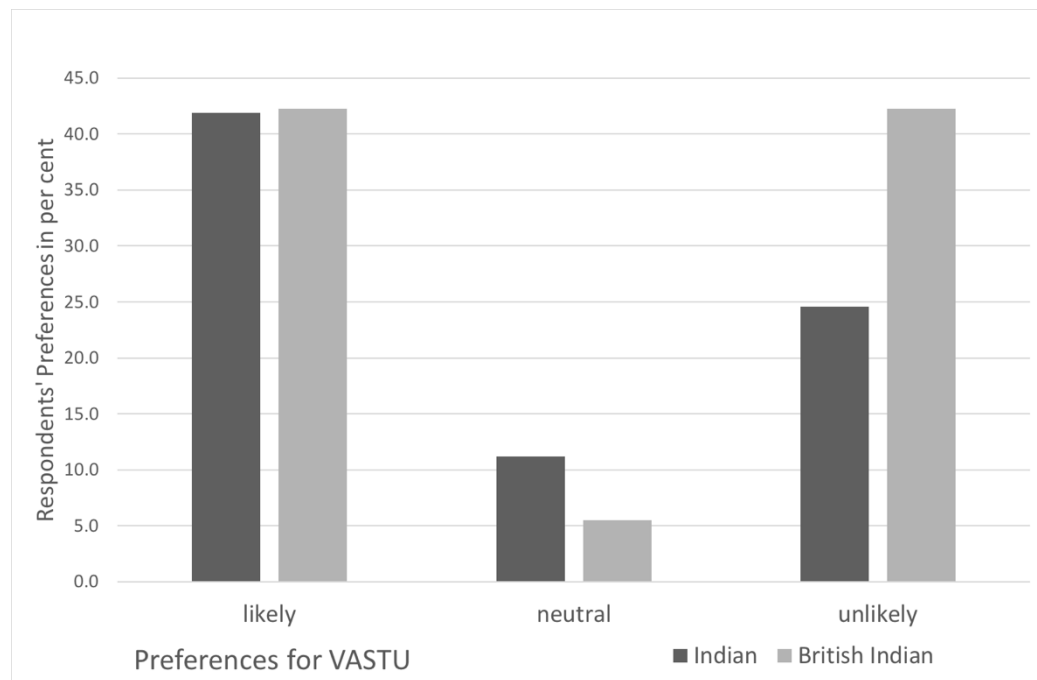


Fig. 10 . Respondents' attitudes to Vastu: British Indian only.

## 5. Discussion and Conclusion

The survey findings presented in this paper engage with understanding patterns of energy use in housing. They address a stated need for more consistent data (Oreszczyn & Lowe, 2010) that tackle social and cultural dimensions (Karvonen, 2013). The findings highlight differences in responses between British Indian and England and Wales population samples in relation to energy use and reduction strategies.

The research examined the British Indian community in two contexts. The first relates their attitudes and practices towards energy conservation in the home. The findings demonstrate a shared understanding of energy consumption and a willingness to save energy (Figs. 2 and 3). However specific practices in the home show some divergence. We have seen that existing research suggests that British Indians heat their homes higher than an assumed set point (Satish, 2017). Similar drivers towards higher energy use are found in comparative indicators around minimising shower use (Fig. 7). However, the survey data also has clear instances of more careful practice in comparison to the broader population when using appliances such as fridges and dishwashers (Fig. 6). Such findings support research that suggests cultural differences affects energy use in the home (Wilhite *et al.*, 1996).

There is some distinction between the influence of family and friends in energy practices with stronger peer awareness in the British Indian sample in comparison with the wider population (Fig. 5.) This may point to a more collectivist culture in both home and diaspora communities as evidenced in research in this field (Hofstede, 2001; Hutnik, 1991). The surveys indicated a divergence as to how British and British Indian households understand how their homes use energy. 45% of British households agreed they do not understand energy within the home in comparison to only 25% in the British Indian sample (Fig. 1). Such a difference may be explained through cultural traits that make choices to meet a perceived expectation of the researcher (Savani, Morris & Naidu, 2012).

The second part of the survey research examined attitudes of the British Indian diaspora community and comparable households in India. Its purpose was to understand if there were particular cultural perspectives specific to an Indian context that remain in the UK.

Here there is evidence of changes in which the household is perceived by British Indians especially in respect to making less overt projections of wealth and status (Fig. 8). It also shows expectations of amenity and comfort similar to the wider society in Britain (Fig. 9). The research demonstrates there are differences in the way in which Indian and British Indian households perceive their home as a means of projecting value. Although there are differences in the kind of values dwellings might espouse, 78% of British Indian and 87% of Indian households see the home as a means of projecting status and cultural sophistication. This reflects broader research around housing and status among Indian diaspora communities (Dasgupta, 1989; Satish, Brennan & Pedreschi, 2011). In terms of promoting low energy practices and undertaking sustainable retrofit, the results may suggest that measures communicated through the appearance of the building may hold more attraction amongst the British Indian community.

However, knowledge of and a preference for Vastu was consistent between both the British Indian and the Indian sample (Fig. 10). This supports research referencing awareness of Vastu in diaspora households (Agrawal, 2006). This is significant in that an affinity for Vastu is culturally specific but also attuned to environmental and consumption narratives (Fazeli & Goodarzi, 2010). The survey suggests that diaspora communities do retain a sense of their originating country's culture and that households both assimilate values of host countries as well as retain an affinity for more traditional practices: the two are not mutually exclusive. A continuing affinity by British Indian communities towards Vastu reinforces the importance of the guidance to produce educational and training material for specific target groups (Elsharkawy & Rutherford, 2015).

Overall the findings of the research indicate clear evidence of assimilation in relation to energy practices in the home by British Indian communities. However, there are some key divergences that the research suggests may be linked to a distinctive British Indian identity that retains elements of traditional cultural practice and values. Understanding these values further will allow for guidance and strategies for energy efficiency to be more precise. Information, training and retrofit specifications that are tailored to the needs of a particular community will be more successful in their goals.

### **5.1 Limitations and further research**

From the outcomes of the surveys, this paper has examined some key aspects of socio-economic preferences and energy behaviour. It has highlighted a lack of detailed research in both quantitative and qualitative practices in diaspora communities. Questions raised in this research around the importance of social relationships, 'virtuous behaviour', house configuration and detailed use suggest deploying energy monitoring, and conducting structured interviews and ethnographic surveys to answer some of the issues raised.

## **6. References**

- Abdellatif, M. & Al-Shamma'a, A. (2015) 'Review of sustainability in buildings'. *Sustainable Cities and Society*, 14 (1), pp. 171-177.
- Agrawal, S. K. (2006) 'Housing adaptations: A study of Asian Indian immigrant homes in Toronto'. *Canadian Ethnic Studies Journal*, 38 (1), pp. 117-130.
- Ahmed, K., Akhondzada, A., Kurnitski, J. & Olesen, B. (2017) 'Occupancy schedules for energy simulation in new prEN16798-1 and ISO/FDIS 17772-1 standards'. *Sustainable Cities and Society*, 35 pp. 134-144.
- Al-Marri, W., Al-Habaibeh, A. & Watkins, M. (2018) 'An investigation into domestic energy consumption behaviour and public awareness of renewable energy in Qatar'. *Sustainable Cities and Society*, 41 pp. 639-646.

- Balnaves, M. (2001) *Introduction to quantitative research methods : an investigative approach*. ed. Caputi, P., London: London : SAGE.
- Becchio, C., Corgnati, S. P., Delmastro, C., Fabi, V. & Lombardi, P. (2016) 'The role of nearly-zero energy buildings in the transition towards Post-Carbon Cities'. *Sustainable Cities and Society*, 27 pp. 324-337.
- Berry, S., Whaley, D., Davidson, K. & Saman, W. (2014) 'Near zero energy homes – What do users think?'. *Energy Policy*, 73 pp. 127-137.
- Bryman, A. (2008) *Social research methods / Alan Bryman*. Oxford, [England] ; New York, N.Y. : Oxford University Press, 2008. 3rd ed.
- Carlsson-kanyama, A., Lindén, A. I. & Eriksson, B. (2005) 'Residential energy behaviour: does generation matter?'. *International Journal of Consumer Studies*, 29 (3), pp. 239-253.
- Census (2011) *Census statistics*. Office for National Statistics:  
<https://www.ons.gov.uk/census/2011census>.
- Chakrabarti, V. (1999) *Indian Architectural Theory and Practice: Contemporary Uses of Vastu Vidya*. Surrey: Routledge.
- Chandrasekaran, C. (1986) 'The Mysore study'. *Popul Bull UN*, (19-20), pp. 6-13.
- D.Thomas, W. & J.Duffy, J. (2013) 'Energy performance of net-zero and near net-zero energy homes in New England'. *Energy and Buildings*, 67 pp. 551-558.
- Danilov-Danil'yan, V., Losev, K. & Reyf, I. (2009) *Sustainable Development and the Limitation of Growth: Future Prospects for World Civilization*. Future Prospects for World Civilization. Berlin, Heidelberg: Springer Berlin Heidelberg, Berlin, Heidelberg.
- Dasgupta, S. S. (1989) *On the Trail of an Uncertain Dream: Indian Immigrant Experience in America*. New York: AMS.
- DfCLG, D. f. C. a. L. G. (2017a) *Dwelling Stock Estimates: 2016, England*. Department for Communities and Local Government, London:
- DfCLG, D. f. C. a. L. G. (2017b) *Housing supply; net additional dwellings, England: 2016-17*. Department for Communities and Local Government, London:
- Elsharkawy, H. & Rutherford, P. (2015) 'Retrofitting social housing in the UK: Home energy use and performance in a pre-Community Energy Saving Programme (CESP)'. *Energy and Buildings*, 88 pp. 25-33.
- Encinas Pino, F. & de Herde, A. (2011) 'Definition of occupant behaviour patterns with respect to ventilation for apartments from the real estate market in Santiago de Chile'. *Sustainable Cities and Society*, 1 (1), pp. 38-44.
- EnerGAware (2017) 'EnerGAware project'. <http://www.energaware.eu/>,  
<http://www.energaware.eu/>. (Accessed: 10 June 2017).
- Fanger, P. O. (1972) *Thermal comfort : analysis and applications in environmental engineering*. New York: New York : McGraw-Hill.
- Fazeli, H. & Goodarzi, A. (2010) 'The principles of Vastu as a traditional architectural belief system from an environmental perspective'. *WIT Transactions on Ecology and the Environment*, 128 pp. 97 - 108.
- Fernandes, L. (2000a) 'Nationalizing 'the global' media images, cultural politics and the middle class India'. *Media, Culture & Society*, 22 pp. 611-628.
- Fernandes, L. (2000b) 'Restructuring the new middle class in Liberalizing India'. [in *Comparative studies of South Asia, Africa nad Middle east*. 20. (Accessed:Fernandes, L.
- Fernandes, L. (2006) *India's new middle class: democratic politics in an era of economic reform*. Minneapolis, Minn.: University of Minnesota Press.

- Gianfrate, V., Piccardo, C., Longo, D. & Giachetta, A. (2017) 'Rethinking social housing: Behavioural patterns and technological innovations'. *Sustainable Cities and Society*, 33 pp. 102-112.
- Groat, L. N. & Wang, D. (2002) *Architectural research methods*. New York: J. Wiley.
- Hagbert, P. & Bradley, K. (2017) 'Transitions on the home front: A story of sustainable living beyond eco-efficiency'. *Advances in Building Energy Research*, 31 pp. 240-248.
- Hall, S. (1994) 'Cultural identity and diaspora', in Williams, P. and Chrisman, L. (eds.) *Colonial discourse and post-colonial theory*. New York: Columbia University Press.
- Hayles, C. S. & Dean, M. (2015) 'Social housing tenants, Climate Change and sustainable living: A study of awareness, behaviours and willingness to adapt'. *Sustainable Cities and Society*, 17 pp. 35-45.
- Higgins, N. (2018) *Dwelling Stock Estimates: 2017, England*. Ministry of Housing, Communities & Local Government: National Statistics, [housing.statistics@communities.gsi.gov.uk](mailto:housing.statistics@communities.gsi.gov.uk).
- Hofstede, G. H. (2001) *Culture's consequences : comparing values, behaviors, institutions, and organizations across nations*. 2nd ed. edn. Thousand Oaks, Calif: Thousand Oaks, Calif : Sage Publications.
- Hutnik, N. (1991) *Ethnic Minority Identity in Britain: A social psychological perspective*. 2nd ed. edn. Oxford, GB: Clarendon Press.
- Issar, T. P. (1991) *Mysore - the royal city*. Bangalore: My tec process Pvt. Ltd.
- Jones, R. V., Fuertes, A., Boomsma, C. & Pahl, S. (2016) 'Space heating preferences in UK social housing: A socio-technical household survey combined with building audits'. *Energy and Buildings*, 127 pp. 382-398.
- Kane, T., Firth, S. K. & Lomas, K. J. (2015) 'How are UK homes heated? A city-wide, socio-technical survey and implications for energy modelling'. *Energy and Buildings*, 86 pp. 817-832.
- Kannan, S. & Jani, V. (2010) 'Role of Vaastu in Contemporary Residential Design'. *Design Principles and Practices: An International Journal*, 4 (5), pp. 75 - 90.
- Karvonen, A. (2013) 'Towards systemic domestic retrofit: a social practices approach'. *Building Research & Information*, 41 (5), pp. 563-574.
- Konstantinou, T. & Knaack, U. (2013) 'An approach to integrate energy efficiency upgrade into refurbishment design process, applied in two case-study buildings in Northern European climate'. *Energy & Buildings*,
- Lindén, A.-L., Carlsson-Kanyama, A. & Eriksson, B. (2006) 'Efficient and inefficient aspects of residential energy behaviour: What are the policy instruments for change?'. *Energy Policy*, 34 (14), pp. 1918-1927.
- Lindridge, A. (2010) 'Are we fooling ourselves when we talk about ethnic homogeneity? The case of religion and ethnic subdivisions amongst Indians living in Britain'. *Journal of Marketing Management*, 26 (5-6), pp. 441-472.
- Makantasi, A. M. & Mavrogianni, A. (2016) 'Adaptation of London's social housing to climate change through retrofit: a holistic evaluation approach'. *Advances in Building Energy Research*, 10 pp. 99-124.
- Mcmichael, M. & Shipworth, D. (2013) 'The value of social networks in the diffusion of energy-efficiency innovations in UK households'. *Energy Policy*, 53 pp. 159-168.
- Mehta, R. & Belk, R. W. (1991) 'Artifacts, Identity, and Transition: Favorite Possessions of Indians and Indian Immigrants to the United States'. *Journal of Consumer Research*, 17 (4), pp. 398-411.



Mills, B. & Schleich, J. (2012) 'Residential energy-efficient technology adoption, energy conservation, knowledge, and attitudes: An analysis of European countries'. *Energy Policy*, 49 pp. 616-628.

Ministry of Housing, C. a. L. G. (2017) *English Housing Survey*. Ministry of Housing, C.a.L.G. London:

Monteiro, H., Fernández, J. E. & Freire, F. (2016) 'Comparative life-cycle energy analysis of a new and an existing house: The significance of occupant's habits, building systems and embodied energy'. *Sustainable Cities and Society*, 26 pp. 507-518.

Nicol, F. (2012) 'Adaptive thermal comfort principles and practice', in HUMPHREYS, M.A. and ROAF, S. (eds.). Abingdon, Oxon England ; New York, N.Y: Routledge.

Niu, S., Pan, W. & Zhao, Y. (2016) 'A virtual reality integrated design approach to improving occupancy information integrity for closing the building energy performance gap'. *Sustainable Cities and Society*, 27 pp. 275-286.

Oonk, G. (2007) *Global Indian Diasporas*. Amsterdam University Press.

Oreszczyn, T. & Lowe, R. (2010) 'Challenges for energy and buildings research: objectives, methods and funding mechanisms'. *Building Research & Information*, 38 (1), pp. 107-122.

Pan, W. & Garmston, H. (2012) 'Compliance with building energy regulations for new-build dwellings'. *Energy*, 48 (1), pp. 11-22.

Patra, R. (2009) 'Vaastu Shastra: Towards Sustainable Development'. *Sustainable Development*, 17 pp. 244-256.

Ram, S. (1987) 'Indians in England: why did they emigrate?'. *Population Geography*, 9 (1-2), pp. 37-44.

Ren, Z., Chan, W. Y., Wang, X., Anticev, J., Cook, S. & Chen, D. (2016) 'An integrated approach to modelling end-use energy and water consumption of Australian households'. *Sustainable Cities and Society*, 26 pp. 344-353.

Satish, B., Brennan, J. & Pedreschi, R. (2011) 'Influence of affluence on sustainable housing in Mysore, India'. *Proceedings of the Institution of Civil Engineers, Engineering Sustainability*, 164 (4), pp. 249-260.

Satish, B. K. (2013) 'Sustainable housing futures for a growing middle class: a contextual study of Mysore, India'. [in *Ph.D. thesis*. The University of Edinburgh. PhD. (Accessed: Satish, B. K.

Satish, B. K. (2017) 'Modelling energy use behaviour of British Asian households', *Sustainable Earth 2017: A global forum for connecting research with action*. Plymouth, UK Plymouth University.

Satish, B. K. & Brennan, J. (2015) 'Significance of boundary conditions towards sustainable housing strategies: a case study of Mysore, India'. *IAFOR Journal of Sustainability, Energy and the Environment*, 2 (1), pp. 21-40.

Savani, K., Morris, M. W. & Naidu, N. V. R. (2012) 'Deference in Indians' Decision Making: Introjected Goals or Injunctive Norms?'. *Journal of Personality and Social Psychology*, 102 (4), pp. 685-699.

SDC (2006) *Climate Change – The UK Programme 2006: SDC response*. <http://www.sd-commission.org.uk/>: sustainable development commission. Available.

Sharma, S. (2017) 'Social and Political Participation of Indian Diaspora in the UK'. *International Studies*, 51 pp. 118-132.

Sinha, A. (1998) 'Design of Settlements in the Vaastu Shastras'. *Journal of Cultural Geography*, 17 (2), pp. 27-41.

- Sinha, J. (1999) 'Confluence of Cultural and Multinational Influences: A New Paradigm for Organizational Behaviour'. *Indian Journal of Industrial Relations*, 35 (1), pp. 27-42.
- Skea, J. & Nishioka, S. (2008) 'Policies and practices for a low-carbon society'. *Climate Policy*, 8 pp. 5-16.
- Stephenson, J., Barton, B., Carrington, G., Gnoth, D., Lawson, R. & Thorsnes, P. (2010) 'Energy cultures: A framework for understanding energy behaviours'. *Energy Policy*, 38 (10), pp. 6120-6129.
- Tahir, F. & Walker, I. (2013) *Review of potential for carbon savings from residential energy efficiency*. Cambridge: The Committee on Climate Change, Energy Saving Trust. Available.
- Varma, P. K. (2007) *The great Indian middle class*. New Delhi: Penguin.
- Vogt, W. P. (2007) *Quantitative research methods for professionals*. Boston, MA: Boston, MA : Pearson/Allyn and Bacon.
- Waters, L. (2017) *Energy Consumption in the UK: Overall energy consumption in the UK since 1970*. Department for Business, E.I.S.
- White, E. (2012) *Ethnicity and National Identity in England and Wales: 2011*. Office for National Statistics:  
<https://www.ons.gov.uk/peoplepopulationandcommunity/culturalidentity/ethnicity/articles/ethnicityandnationalidentityinenglandandwales/2012-12-11>.
- Wilhite, H., Nakagami, H., Masuda, T., Yamaga, Y. & Haneda, H. (1996) 'A cross-cultural analysis of household energy use behaviour in Japan and Norway'. *Energy Policy*, 24 (9), pp. 795-803.